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# American Fern Journal

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Vol. 2

APRIL, 1912

No 2.

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## Notes of a naturalist afloat—III

WILLIAM EDWIN SAFFORD

(PLATES 2, 3)

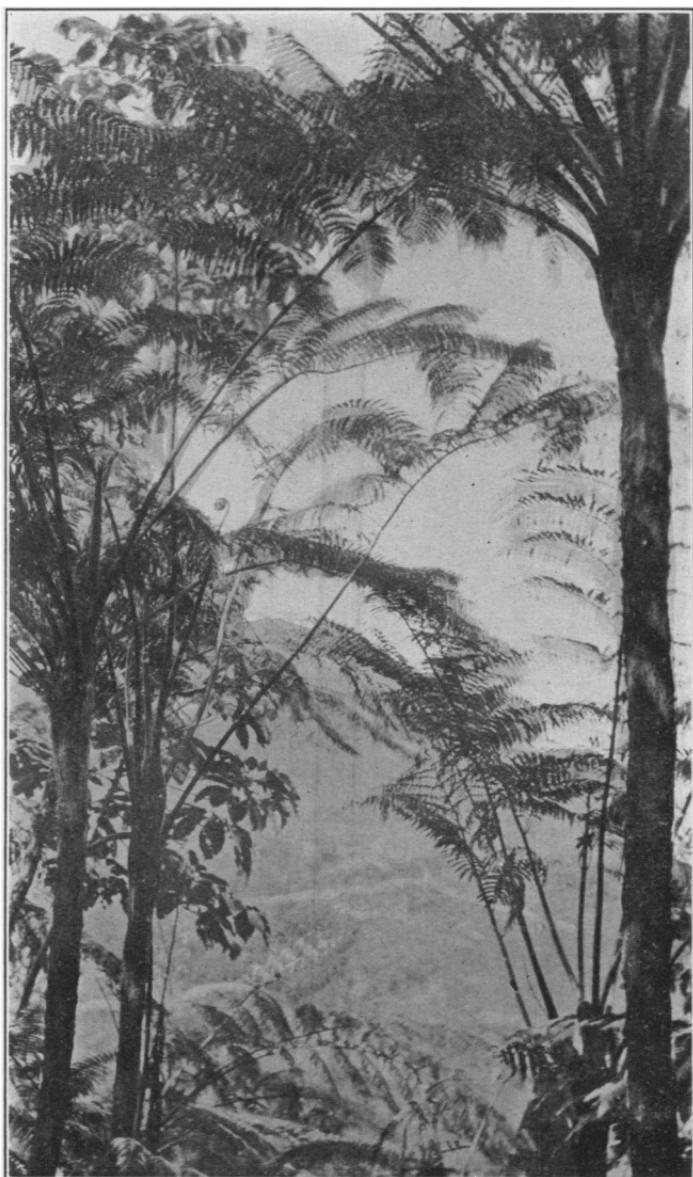
### PORTO RICO

The island of Porto Rico is situated in the path of the moisture-laden trade winds. It has an abundant rainfall, yet such is the nature of its topography that the northern part gets more than its share of water while the southern coast is comparatively arid and is covered with xerophytic vegetation.

On my first visit to the island it seemed a vision of paradise as the mists cleared away and revealed the mountains of Luquillo with their silvery, threadlike cascades and the cloud-capped peak of El Yunque rising from their midst. On my second visit, sixteen years later, when I landed on the south coast amid scrubby Cactaceae and other desert plants, it suggested rather a scene from the inferno.

It was on St. Valentine's day, February 14, 1882, after a rough eight days' passage from Norfolk, that we found ourselves a little to the eastward of our reckoning, off the northeastern corner of the island. Our dignified old vessel had taken advantage of the gale to behave in a most frisky and unseemly manner, like a dowager in carnival time. Nearly everybody on board, including the captain, had been seasick and we were all anxious

[No. 1 of the JOURNAL (2: 1-32. pl. 1) was issued 29 F 1912.]



TREE FERN, CYATHEA ARBOREA (L.) J. E. Sm.

Luquillo Mountains, Porto Rico

to get ashore. I remember the apple-green stretches of sugar cane, as we steamed along the north coast back to the entrance of San Juan harbor; the little huts nestling under palm trees along the shore; the schools of flying-fish which scurried out of the way of the pilot boat that came out to meet us, like grasshoppers from the path of a rambler through summer fields; the consequential little Spanish pilot who did not know a word of English, for whom I was obliged to act as interpreter; the venerable Castillo del Morro, guarding the narrow entrance to the landlocked harbor; the swarm of bumboats coming out to sell us "chinas" and "guineos," which we found out to be new names for oranges and bananas; the high, massive walls surrounding the ancient city, founded by Ponce de Leon more than a hundred years before the landing of the Pilgrim Fathers.

I can recall now the peculiar sensation I felt as we entered the city through the great gate; how impressed I was with the fortress of San Cristobal; the narrow, paved streets and the cries of the street venders; the ladies with their black mantillas and their attendant maids or chaperons; the politeness of our barefoot negro guide, who "kissed the feet" of every old colored woman we passed; the glimpses of inner courts, or patios, through the doors of the square whitewashed or blue-washed houses; the delicious black coffee and the white unsalted butter at the hotel; the excursion on the little tramway to the suburban village of Rio Piedras, with its clumps of coconuts and bananas; the Spanish soldiers in the streets; the Spanish players at the theater, who sang fascinating "jotas" and danced graceful "boleras;" the no less fascinating islanders in the cafes and dance halls who sang of "la negra Tomasa," or called their sweethearts "caramelitas de miel," and danced the "Borinquen" to music accented by the scraping of corrugated gourds called "güicharas," or "carachos." But I must

refrain: there is not space here to tell of all the novel and interesting features of San Juan, which gave us our first impression of the island and made us realize that we were in a country with customs and etiquette very different from our own.

At the hotel, where I dined with a native Portoriqueño, I heard a discussion of island politics. There seemed, even at that time, to be dissatisfaction with the mother country. I was told that the islanders were overtaxed, the merchants compelled to pay unjust licenses, the lower classes treated like slaves and the better class with disdain. Enormous sums were squandered in keeping the city wall in repair; and nothing had been done toward establishing good roads throughout the island. The cost of the army was enormous. No recruiting among the islanders was permitted, but all soldiers were brought from Spain. The conversation suddenly ceased as a Spanish officer passed our table; but one of the gentlemen added under his breath: "We have the same heart, the same soul as Cuba. Wait! Our time will come some day."

It did come, shortly before my second visit, which was in the summer of 1898. When we landed at the Playa of Ponce we heard how our invading army had been received by the islanders. We had expected resistance; we were met with showers of oranges, bananas, and cigars, and with cries of "vivan los Americanos!" We also heard a pitiful story about the venerable Spanish commander, Colonel San Martin, who found himself deserted by his men and forced to abandon the defense of Ponce. Afterwards we read of his trial and ignominious condemnation by court martial.

At the time of my first visit there was little opportunity for doing any botanical work in the vicinity of San Juan. When we attempted to make an excursion into the interior we found the roads in miserable condition, and our

tough diminutive horses sank to their knees at every step. A visit to the Luquillo Mountains, which had appeared so inviting from the sea, was out of the question, and much of the country that was accessible had an exhausted, worn-out look which was disappointing. We crossed the harbor to Cataño, where we found a characteristic mangrove formation, and we explored a short stretch of the seacoast, outside the harbor, where the strand vegetation proved to be very similar to that of the Florida Keys.

In the market of San Juan there were many tropical fruits and other products which were new to us. In addition to oranges, bananas, and mangos, which were introduced on the island after its discovery, there were also fruits which grew there in prehistoric times, and which are mentioned by Oviedo. Among the latter are pineapples (*Ananassa ananas*), the soursop or guanábana (*Annona muricata*), the sugar apple or anon (*Annona squamosa*), the mamey (*Mammea americana*), the tuna or prickly pear (*Opuntia* sp.), pitahaya (*Cereus triangularis*), jagua (*Genipa americana*), the hobo or hog plum (*Spondias lutea*), caymito (*Chrysophyllum cainito*), and the icaco or beach plum (*Chrysobalanus icaco*). Other pre-Columbian products were the yuca or cassava plant (*Manihot manihot*), from which the aborigines made a kind of bread; mani or peanuts (*Arachis hypogaea*); aji or red peppers (*Capsicum annum* and *C. frutescens*); maize or Indian corn (*Zea mays*); sweet potatoes (*Ipomoea batatas*), which they called "ajes;" yahutias or Carib cabbage (*Xanthosoma violaceum* and *X. sagittae-folium*), which are aroids with starchy roots, allied to the Polynesian taro; and lerenes (*Calathea allouia*), allied to arrowroot. Among other endemic products were tobacco and annatto (*Bixa orellana*), the latter of which was used by the aboriginal Borinqueños to paint their bodies. Yams (*Dioscorea* spp.) were brought to the

island from Africa at an early date, in all probability as food for the negro slaves, who took the place of the aboriginal Indians exterminated through the persecution by the Spaniards.

Between my first and second visits I added considerable material from various sources to my notes on island vegetation, and I have amplified them since from herbarium material in the National Museum; chiefly from the collections of Mr. George P. Goll, who accompanied Mr. O. F. Cook and Mr. Guy N. Collins, of the U. S. Department of Agriculture, on their expedition to the island in 1899;\* as well as from the report of Professor L. M. Underwood, who, together with Mr. Robert F. Griggs, accompanied them on a second visit in 1901.

Before my second visit, in the summer of 1898, a fine military road had been constructed across the island from San Juan to Ponce. I shall never forget my first drive from the Playa, where we landed, on the south coast of the island, to the city of Ponce. On both sides of the road there were lines of magnificent flamboyant trees (*Poinciana regia*) in full bloom. In some countries these are called fire trees; and the name is well chosen, for their spreading crowns seemed fairly ablaze with clusters of orange-red flowers. The city impressed us favorably, with its clean streets, its shady park, and its Spanish-looking houses with their patios filled with ornamental plants. On a neighboring hillside I saw an interesting collection of fruit trees, among them the genepa or quenipa (*Melicocca bijuga*), a tree belonging to the Soapberry family, with pleasantly flavored egg-shaped, pulpy fruits. Another member of this family introduced from Africa is the akee, *Blighia sapida*. Its pearshaped fruit is red on the outside, three-celled within, with glossy black seeds surrounded by a bright yellow

\* See Cook, O. F., and Collins, G. N. Economic plants of Porto Rico. Contributions from the U. S. National Herbarium 8: 57-269. 1903.

aril. The latter is the part eaten, either stewed, fried, or baked. On the Isle of Pines it is known as "brain food."

The limestone region to the westward of Ponce is characterized in many places by scrubby vegetation including cactus thickets. There are also several palmettos, including *Inodes causiuarum* Cook, from which the natives make hats, and *Thrinax ponceana* Cook, of which this is the type locality. Near the village of Guayanilla there is a veritable cactus forest including columnar and quadrangular forms of *Cereus*, treelike and prostrate opuntias, and the "melon de costa" (*Melocactus portoricensis*.) Other xerophytic plants of this region are the aromatic *Amyris balsamifera*, species of *Bumelia*, *Forestiera*, *Zamia*, the troublesome burgrass *Cenchrus tribuloides*, and saltbushes belonging to the genera *Atriplex* and *Salicornia*.

The military road across the island rises gradually from Ponce to Juana Diaz. At this village fine specimens of the Porto Rican royal palm (*Roystonea borinquena* Cook) have been planted, together with the co-rozo palm of the island (*Acrocomia media* Cook). These palms bear a general resemblance to each other from a distance. Both have a columnar, somewhat bulging stem and a crown of pinnate leaves; but the *Roystonea* leaves have sheathing bases, called "yaguas" by the natives, who often use them for covering their houses; and the *Acrocomia* may be recognized by the needlelike prickles with which its stem is armed.\*

Between Juana Diaz and Coamo the roadsides are bordered in places by banks of maidenhair (*Adiantum fragile*) and silver fern (*Ceropteris calomelaena*). Near Coamo, at a resort celebrated for its medicinal springs, many beautiful shrubs and climbers have been planted,

\* See Cook, O. F. A synopsis of the palms of Puerto Rico. Bull. Torrey Club 28: 526-569. 1901.

including the yellow-flowered *Bignonia unguis*; and in the vicinity grow tamarinds, sapodillas, and other fruits together with the starch-yielding marunguey (*Zamia media*). Near the margins of the springs grow the "culantrillos del pozo," *Adiantum capillus-veneris* and *A. tenerum*; in the neighboring swamp *Acrostichum aureum*, so often found in marshes near the sea; and in the water of ditches, *Ceratopteris deltaidea*.

Beyond Coamo the road dips down into a deep valley and crosses a little river by a well constructed bridge. It then begins to climb toward the mountain pass of Aibonito, the point where the Spaniards took their stand to resist the American invasion. Magnificent views present themselves one after the other as the road winds about a labyrinth of mountain ridges, with the beautiful blue Caribbean Sea to the southward. Then, after passing beneath a lofty cliff, the mountain pass is reached and beyond it the village of Aibonito.

Approaching Cayey, farther on, there occurs a perceptible change in the temperature, owing to the cool moisture-laden breeze which almost continuously sweeps the crests of the hills. This is the main tobacco center of the island. Beautiful tree ferns, *Cyathea arborea*, and dense groves of mountain palms (*Acrista monticola*) make their appearance, together with trees of the genera *Tecoma* and *Tabebuia*, of the *Bignonia* family, called robles; and a rubiaceous shrub (*Hamelia patens*) called balsamo, with orange-red flowers. Among the ferns of this vicinity are *Dennstaedtia adiantoides*, *Asplenium dentatum*, *Polypodium aureum*, and the pretty golden fern, *Ceropteris sulphurea*. From Cayey a branch road leads to Guayama, on the southeast coast of the island, most of the way along a mountain ridge, where there are groves of mountain palms, clumps of tree ferns, rank-growing Heliconias, and among them such ferns as *Polypodium crassifolium* and *Hemionitis palmata*, associated with succulent aroids,

Melastomas and Piperaceae. At Guayama there are sugar plantations and many useful plants, including a triangular cactus (*Cereus*), which climbs over walls and bushes and bears edible pitahayas, as large as goose eggs.

Returning to Cayey, the road proceeds northward toward Caguas, shaded in places by trees clothed with epiphytal ferns, and passing numerous clumps of tree ferns, *Cyathea arborea*. At the village of Beatriz occurs an interesting prickly-stemmed climbing fern, *Odontosoria dumosa*. The village of Caguas is composed of houses resembling the aboriginal dwellings of Porto Rico, thatched with palm leaves, and the sides of many of them covered with yaguas or the bases of leaves from the royal palm. Breadfruit trees and taro (*Colocasia esculenta*), here called "yautia malanga," give it a Polynesian aspect. To the westward of Caguas, near Aguas Buenas, are some interesting caves, the openings to which are curtained with tapestry of ferns.

Between Caguas and Rio Piedras, the road is bordered in places with *Cyclopeltis semicordata* and *Asplenium dentatum*, and shortly before reaching Rio Piedras there is a beautiful shady bank covered with *Blechnum occidentale*, associated with succulent Piperaceae, and 3-ribbed Melastomaceae. (See PLATE 3.) At Rio Piedras, formerly the suburban residence of the Spanish governors of Porto Rico, there are many introduced ornamental shrubs and trees.

I have already referred to the mangrove formation at Cataño, across the harbor from San Juan. Here with the mangroves grow the alligator apple (*Annona glabra*), the seaside grape (*Coccolobis uvifera*), and the swamp ferns *Acrostichum aureum* and *Blechnum serrulatum*.

Not far from Cataño, and connected with it by a diminutive narrow-gauge road across the marshes, is the town of Bayamon, now the center of an important orange and grapefruit industry, a very fertile region where



BLECHNUM OCCIDENTALE, MELASTOMACEAE PIPERACEAE, etc.

Roadside bank between Rio Piedras and Caguas

Photograph by Guy N. Collins

tropical fruits of all kinds grow luxuriantly. This place is the home of Dr. Augustin Stahl, the eminent botanist and archeologist of the island, and his accomplished daughter. For some distance to the westward the rich soil continues, offering an inviting field for American enterprise, especially for the cultivation of citrus fruits.

On proceeding along the north coast toward Arecibo, palms of several species are encountered. Near the shore, there are stretches of sand and occasional saline ponds surrounded by desertlike vegetation. Farther inland a series of domelike hills can be seen, which at one time were probably coral islands. These are covered with forest trees, and above the general level of vegetation the crests of palms (*Aeria attenuata* Cook), which from a distance appear to be floating in the air; for their trunks are so slender as to be invisible. This part of the coast recalls the eastern extremity of the island of Cuba, where similar palms can be seen from the sea.

At Arecibo occurs another palm (*Thrin coma alta* Cook) with a remarkably tall and slender trunk, and in the immediate vicinity extensive fields of sugar cane may be seen. From Arecibo a road leads southward to Utuado, offering a succession of magnificent views, as it follows the winding valley of the Rio Grande.\* First a limestone region is encountered and the road passes beneath high cliffs crowned with endemic fan palms; then a metamorphic region, where the character of the vegetation changes abruptly; then coffee plantations make their appearance, for this part of the island is the principal center of the coffee industry.

Higher up appear beautiful tree ferns, *Hemitelia horrida*, with short spiny trunks, and *Cyathea arborea*, with trunks sometimes 25 to 30 feet high. This portion of the island offers a most inviting field to the botanist.

\* See Underwood, Lucien M. Report on a trip to Porto Rico. Journ. N. Y. Bot. Garden 2: 166-173. 1901.

Many of the coffee plantations are reached only by mountain trails across ridges and ravines, which yield a rich and varied harvest. At Isolina, westward from Ciales, there is an area of primeval forest, including magnificent specimens of tabanuco trees (*Dacryodes excelsa*), the straight smooth white trunks of which sometimes rise to a height of more than a hundred feet.

Near Utuado the slopes are more or less deforested, but there are beautiful clumps of royal palms (*Roystonea borinquena*) which add grace to the landscape, and in the ravines there are rank growths of ferns, aroids, Piperaceae, and Melastomaceae. Higher up there are groves of mountain palms (*Acrista monticola*), and the limbs and trunks of the hardwood trees are clothed with filmy ferns (*Trichomanes*), *Elaphoglossum*, and epiphytal polypodies. The road from Utuado to Adjuntas, which has been completed since the American occupation, is no less picturesque than that to the northward, with the slopes of the mountains dotted here and there with clumps of Roystoneas and corozo palms (*Acrocomia media*). In the vicinity of Adjuntas there are several wooded mountain peaks with their trees covered with epiphytal ferns. From Adjuntas to Ponce the road passes through coffee plantations, shaded with bananas or introduced Ingas and Erythrinias.\* Farther on, the vegetation becomes more xerophytic. The royal palms are replaced by palmettos, and the forest ferns by species of *Notholaena* and *Cheilanthes*; and Cactaceae, Zamias, and scrubby bushes cover the rocky limestone formation.

Along the west coast, which is much drier than the north coast, there are several fine groves of mangos, especially in the vicinity of Cabo Rojo.† At the inter-

\* See Cook, O. F. Shade in coffee culture. U. S. Dept. Agr. Bot. Bull. 25; Agriculture in the tropical islands of the United States. Yearbook U. S. Dept. Agr. 1901: 358. *pl. 43.* 1902.

† See Collins, Guy N. The mango in Porto Rico. U. S. Dept. Agr. Plant Ind. Bull. 28: *pl. 1.* 1903.

esting old town of Mayagüez an Agricultural Experiment Station has been established. Considerable sugar is produced in this vicinity, as well as excellent pineapples; and this is the principal center of the hat-making industry, on account of the groves of palmettos (*Inodes causarum*) which grow here spontaneously. The well known *Carlu-dovica palmata*, from which the so-called Panama hats are made, has been introduced in this region together with many other useful plants. Aguadilla, a port near the northwest corner of the island is connected by roads with coffee plantations in the interior, the most important of which are about San Sebastian; and near Isabel on the north coast, pomelos or grapefruits, said to be the most delicious in the world, are now produced and sent in quantities to foreign markets.

But the forests of the Luquillo Mountains, at the opposite extremity of the north coast of the island, are more interesting to the botanist, and are so important from the conservationist's point of view that they have been made a forest reserve.\* Here, between the altitudes of 500 and 2,000 feet occur four of the most important timber trees of the island: the tabanuco, laurel sabino, ausubo, and guaraguao. Of the tabanuco (*Dacryodes excelsa*) I have already spoken in connection with the forest of Isolina. When scarred, its trunk yields an aromatic resin, sometimes called "mountain incense" in the West Indies. The beautiful laurel sabino (*Magnolia splendens*), which yields a handsome hard wood, is called laurel on account of its aromatic properties. The ausubo is a species of *Mimusops* (*M. nitida*), belonging to the sapota family; and the guaraguao (*Guarea trichilioides*), belonging to the mahogany family, is a relative of the Spanish cedar, of which cigar boxes are made. Trees of less importance are the palo colorado, or cedro macho

\* See Gifford, John C. The Luquillo Forest Reserve, Porto Rico. U. S. Dept. Agr. Forest Bull. 54. 1905.

(*Hufelandia pendula*), a true laurel; and the leguminous “moca” (*Andira jamaicensis*) with purplish papilionaceous flowers and rounded or elliptical, one-seeded pods, which are much relished by bats. Among the lianas are species of *Philodendron* and *Anthurium*, belonging to the arum family; a wild yam (*Rajania Sintenisii*), and the “bejuco de palma” (*Marcgravia Sintenisii*). There are also succulent Begonias with pink flowers (*B. portoricensis*); Realnemias, allied to the gingers and Alpinas; and a number of Melastomaceae and Piperaceae. One of the most disagreeable features of the region is the occurrence of cutting sedges called cortadero, or razor grass (*Scleria* spp.).\*

Above the elevation of 2,000 feet the timber is for the most part stunted and gnarled and clothed with mosses, lycopods, and epiphytal ferns. From the summit of El Yunque, elevated about 3,500 feet above the sealevel, the interior basin appears like a sea of palm crests (*Acrista monticola*), with occasional islands of dark-leaved timber trees.

Among the epiphytal ferns are several species of *Trichomanes*, including the exquisite *T. membranaceum*; *Hymenophyllum polyanthum* and *H. lineare*; *Elaphoglossum apodum*; *Rhipidopteris peltata*; the bird's nest fern (*Asplenium serratum*); *Ophioglossum palmatum*; and several species of *Polypodium*, including *P. serrulatum* and *P. trifurcatum*. Other ferns are *Tectaria plantaginea*, *T. trifoliata*, *Dryopteris radicans*, *Asplenium cuneatum*, *Adiantum obliquum*, *A. denticulatum*, *Polypodium aureum*, *Danaea nodosa*, and in open places on the mountain slopes *Dicranopteris bifida*. On the margin of a cascade which plunges down the steep slope of Mt. Jimenez, are soft curtains of *Adiantum*, banks of *Dryopteris*, *Antrophyum*, and *Ceropteris*, and the interesting

\* See Wilson, Percy. Report on a trip to Porto Rico. Journ. N. Y. Bot. Gard. 3: 178, 179. 1902.

*Fadyenia prolifera*, the fronds of which take root at their tips like our own walking fern.\*

But the crowning glory of the Pteridophytes are the tree ferns. Nothing more graceful can be imagined than *Cyathea arborea*, with its slender trunk, its young fronds uncurling at the tips like bishops' crooks, and its lacelike pinnae silhouetted against the sky. The accompanying illustration (PLATE 2, frontispiece), reproduced from a photograph in Dr. John C. Gifford's report on the Luquillo Forest Reserve, will serve to show its beauty better than any possible description. Other tree ferns of these mountains are *Cyathea portoricensis*, the prickly-stemmed *Hemitelia horrida*, and at least two species of *Alsophila*.

I have neglected to mention the caves which occur in various localities on the island. Some of them furnish a supply of bat guano, which has been found to be highly beneficial in fertilizing worn-out sugar fields and other areas exhausted by centuries of cultivation. In these caves various articles of archeological interest have been found. But there is not space here to speak of the vestiges of the aboriginal inhabitants of Porto Rico, some of which, especially objects of stone in the shape of horse collars and peculiar three-pointed stones, are to be classed among the enigmas of archeology.†

As I think of the beautiful island with its tree-clad hills, its picturesque valleys, and smiling fields of sugar cane, I rejoice that it is ours. It is to be hoped that the natives will realize the advantages we have brought them. We have facilitated the means of transportation by constructing roads and railways which will enable them to bring their produce to market; we have created a forest reserve and have taken steps to reclaim extensive denuded areas; we have established an island agricultural

\* See Urban, Ignatius. Symb. Ant. 4. 1903-1911.

† See Fewkes, J. Walter. The aborigines of Porto Rico and neighboring islands. Annual Rep. Bur. Am. Ethnology 25. 1907.

station and have introduced many useful plants and trees; and we have established schools for the benefit of rich and poor, and have given the citizens a voice in their own government. Complaints sometimes reach the papers, which point to discontent among the islanders; but these may often be traced to disappointed politicians seeking public office, or to taxpayers who expected all taxation to cease after the American occupation of the island. They now ask for the privilege of United States citizenship or autonomy. It remains for us to convince them that we have the real interests of all the islanders at heart, and that every official act is for the lasting benefit of Porto Rico.

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### **Lycopodium selago from Ohio**

LEWIS S. HOPKINS

A short collecting trip was made to Dundee, Tuscarawas Co., Ohio, in the early part of August 1911. While examining the sandstone rocks for *Lycopodium porophilum* Lloyd & Und., which grows here rather plentifully, a plant was found that differs very materially from the typical *L. porophilum*. In fact it was the difference between the two plants which were growing in close proximity to each other that first attracted my attention.

Quite a quantity of the plant was secured, some of which was put in press at once and a part kept green for careful study at a later time. A critical examination of this material shows the plant to have the following characteristics:

Stems rigidly erect, 3-14 cm. high, underground portion very short, with a profusion of roots which form a tangled mass; leaves in more or less irregular zones, yellowish green in color, acuminate or attenuate, hollow at the base; lower leaves, when wilting or drying in press, reflexed; leaves in middle portion of stem spreading;